Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licences

Version 4

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1 Introduction

This document is the guide for preparing information packages (IP) for Tree Farm Licence (TFL) timber supply analyses. The IP documents the assumptions and modelling procedures that are used in preparing the timber supply analysis.

Following the format presented in the guide will facilitate the review by Forest Service and BC Environment staff. However, in recognition of the varied information sources and models in use in the province, it is not a requirement that the format be followed precisely; it may be adjusted to suit the situation of each TFL. However, significant changes to the format presented here or departures from the modelling methods suggested in this document must be discussed with the Timber Supply Forester at Timber Supply Branch before proceeding.

The purpose of the Timber Supply Analysis Information Package is:

- to provide a detailed account of the factors related to timber supply that the Chief Forester must consider under the Forest Act when determining an allowable annual cut (AAC) and how these will be applied in the timber supply analysis.

- to provide a means for communication between licensee, Forest Service and BC Environment staff;

- to provide Forest Service staff with the opportunity to review data and information that will be used in the timber supply analysis before it is initiated;

- to ensure that all relevant information is accounted for in the analysis to a standard acceptable to Forest Service staff;

- to reduce the risk of having analyses rejected because input assumptions and analysis methods were not agreed upon in advance.

This document is intended to provide guidance for the preparation of IPs for TFLs. The licensee is responsible for keeping abreast of changes in forest practices on their licence and developing appropriate methods for reflecting these in their timber supply analyses even if they are not covered in the guide.

2 Process

In accordance with the TFL agreement, the IP must be submitted to the Timber Supply Forester at Timber Supply Branch (TSB) sixteen months before the date management plan in effect for the licence expires. The Timber Supply Forester must review the package within three months after the date on which the Timber Supply Forester receives the package.

The completed IP must be submitted as an appendix to the timber supply analysis.

2.1 Growth and yield

Prior to developing the growth and yield proposal, the licensee should contact Resources Inventory Branch regarding the development of Natural (unmanaged) Stand Yield Tables (NSYT) and Research Branch regarding Managed Stand Yield Tables (MSYT). Items that must be discussed are, for example, site index assignment; proposed yield table development; Operational Adjustment Factors (OAF); and Decay, Waste and Breakage (DW2B) factors, genetic gain, yield table development for selection harvesting etc. Once agreement has been reached on the procedures that will be followed, the proposal must be submitted to the Timber Supply Forester at Timber Supply Branch (this person should be identified in the Regional Manager's review of the current MP).

The growth and yield section of the package will be forwarded by the Timber Supply Forester to Resources Inventory Branch and Research Branch. The growth and yield foresters in the two branches will communicate with the licensee until all growth and yield issues are resolved. The Timber Supply Forester will advise the licensee regarding the conclusion of the growth and yield review and recommend further action if necessary. Information requirements for the review of growth and yield information are in Appendix I.

2.2 Missing data

To facilitate the review by government staff all the information described below (that is relevant to the TFL) must be provided, including area summaries, yield tables, etc.

An explanation must be provided under each section if information is purposefully omitted.

3 Timber supply forecasts / options / sensitivity analyses

The purpose of this section is to provide a summary of the harvest forecasts that will be provided. The set of assumptions pertaining to each option and sensitivity analysis will be covered in detail in later sections.

3.1 Base case

When reviewing timber supply for a management unit, a starting timber supply forecast is needed against which timber supply implications of different management assumptions and of uncertainty in data and assumptions may be measured. This starting harvest forecast is commonly referred to as the base case. It is based on current performance or a reasonable extrapolation of current performance. All requirements that would have to be met when applying for a cutting permit, including requirements for the management of non-timber resources, current harvest systems and methods and silvicultural management regimes, should be considered when developing "current performance" assumptions for the base case.

3.2 Sensitivity analyses

The data and assumptions used in timber supply analysis are often subject to uncertainty. To provide a perspective on the effects on timber supply if the data or assumptions used are in fact incorrect, sensitivity analysis is commonly performed. Usually only one variable (data or assumption) from the information used in the base case is changed for each sensitivity analysis.

A complete analysis of the base case includes sensitivity analysis for most of the variables used in the base case. The purpose of Table 1 is to summarize the sensitivity analyses that will be performed for the base case.

Table 1. Sensitivity analyses

zone/ group/ analysis unit	Sensitivity analysis	magnitude of change
e.g. THLB e.g. partial retention e.g. biogeoclimatic variant	e.g. minimum harvestable age e.g. green-up age old seral age	+/- 10 years +/- 2 years Old seral age - 50 years

Where necessary, assumptions should be described in more detail.

During preparation of the analysis, more issues that warrant sensitivity analysis may become apparent. The licensee must use professional judgement to decide which additional sensitivity analyses are required to provide the chief forester with a good understanding of the timber supply dynamics of the TFL. These sensitivity analyses must also be included in the timber supply analysis report.

3.3 Alternative harvest flows over time

One of the requirements of Section 8 of the Forest Act is that the chief forester consider the short and long term implications to British Columbia of alternative rates of timber harvesting from the area.

Several issues must be considered in developing the base case harvest flow. For example, where harvests are declining, the rate of decline from the current harvest level should be controlled to avoid large and abrupt future harvest shortfalls and the long term level should be stable.

However, there are many possible harvest flows, with different decline rates, starting harvest levels, and potential trade-offs between short- and long-term harvests. Several alternative flow forecasts that will enable the chief forester to assess short-, medium-, and long-term trade-offs must be provided in the analysis.

In this section, describe the decision making process that will be followed to provide appropriate and relevant alternative flow harvest forecasts.

3.4 Other options

In addition to the base case and sensitivity analyses, TFL timber supply analyses may contain options that quantify the impacts on timber supply of pursuing management directions that are different than current management. The purpose of Table 2 is to summarise the issue or management direction each option is intended to reflect. Sensitivity analysis may be warranted to provide a better understanding of the timber supply dynamics associated with each of the options. These must also be included in this table.

The intent of the sections following is to document the assumptions that will be used in the base case. Assumptions associated with each option may be described here, or if more detail is required, under a separate heading for each option at the end of the package.

Table 2. Options

Option Title	Issue to be Tested	Proposed Sensitivity Analysis	
		Title	Range to be tested
Base Case (current management)	e.g. To model the harvest forecast based on current management practices, performance and currently enforced guidelines	See Table 1	
e.g. Non-Conventional (helicopter)	e.g. implications to timber supply of including "non-conventional" harvest areas in the THLB.	e.g. (1) Increased area (2) Reduced area	e.g. increase and reduce non-conventional area by 10%.

4 Model

Provide the following for all models that will be used in the timber supply analyses.

Model Name:

Who developed it and when?

Type:(e.g. simulation, simulated annealing etc.)

Description:

The licensee is responsible for explaining to the Timber Supply Forester how the model applies all assumptions used in the analysis and for explaining results in detail if required. The licensee must provide additional analysis to verify results if these can't be explained to the satisfaction of the Timber Supply Forester.

In addition to spatially implicit (aspatial) models, spatially explicit (spatial) models are now available for use in timber supply analysis. Additional information detailing the function of these models is necessary to help understand the implications of their use to timber supply projections. This information should include details on the criteria used to aggregate polygons into cutblocks and specify how analysis unit level assumptions are aggregated for application at the cutblock level.

For example, what criteria are used in deciding which adjacent polygons are candidates for aggregation into a cutblock. Do they include age limits? Is there a requirement that only polygons dominated by certain species can be aggregated? Can cutblocks straddle zone boundaries?

In addition, when polygons are aggregated into cutblocks, how are the analysis unit level assumptions such as minimum harvestable age and greenup age determined for the block?

5 Current forest cover inventory

The purpose of this section is to describe the current forest cover inventory, to document all the changes to the inventory that have taken place since the last timber supply analysis, and to describe the process that was followed to obtain review and acceptance by the Forest Service. Results from the Forest Service inventory audit must be included here along with the procedure that will be followed in the analysis to account for any discrepancies uncovered in the inventory audit.

Any inventory adjustments arising from the use of the vegetation resources inventory (VRI) or any other sampling procedures must be described in detail. Licensees should review their proposed adjustment procedures/methods with the Timber Supply Forester and Resources Inventory Branch staff prior to submitting the information package. Examples of VRI inventory adjustment methods are available from the Resources Inventory Branch of the MoF.

The licensee should:

(a) Indicate if the forest inventory conforms to current Forest Service standards and explain any differences.

(b) Describe all the changes that were made to the inventory for this analysis (e.g. were any polygon labels changed? Justification for change.)

(c) Describe the review and approval process followed.

(d) Indicate the date of the original inventory and of updates/re-inventories to any or all components of the inventory (e.g. mature, immature).

(e) Indicate to which date the inventory has been updated for (1) depletion and (2) growth. Which date represents time 0 for the harvest forecasts?

(d) Provide the definition of the age classes that are used in the analysis.

(f) Provide any other information that is necessary for a complete understanding of the inventory and any uncertainties associated with it.

5.1 Vegetation Resources Inventory issues

Several TFLs have recently conducted either photo-interpreted (phase I) or ground sampled (phase I followed by phase II) Vegetation Resources Inventories (VRI). These inventories provide estimates of the vegetation cover and its attributes using various remote sensing procedures followed by ground sampling. The initial photo-estimates (e.g. age/height/volume/species, shrub layer etc) are then adjusted by the ground

estimates. For more info on VRI procedures see
http://www.for.gov.bc.ca/resinv/Veginv/home.htm

The methods used in incorporating VRI in timber supply analysis are new and evolving. Licensees should contact the MOF Timber Supply Forester and Resources Inventory Branch staff early in the management planning process to discuss proposed methods with them and ensure the methods are agreeable to all parties.

5.1.1 VRI - Land Base reduction related issues

Where VRI information is available, cultural features (e.g. non-productive forest, alpine forest, swamp, NSR) must be identified for the analysis using the attributes that are available in the VRI. In the IP the attributes, methods and logic used to identify these features must be described in detail. Licensees should discuss with the Timber Supply Foresterwhat the best approach for identifying these features may be.

5.1.2 VRI - Attribute adjustments

In this section the methods used to adjust inventory attributes must be described in detail.

6 Description of the land base

6.1 Timber harvesting land base

6.1.1 Timber Harvesting Land Base determination

The purpose of Table 3 is to summarise the area reductions made to the total area of the TFL to arrive at the land base that is available for timber harvesting. The reductions and additions to the total land base must be listed in the order in which they are applied. Each reduction and addition must be described in more detail in the sections following.

Some of the land base and volume reductions and additions listed in the table may not apply to every TFL. Conversely, more reductions or additions could apply to some TFLs. The following table should be used as a guide for designing a table that represents the TFL being analysed. Licensee staff must however be prepared to explain why any of the listed items are missing in their proposal.

Table 3. Timber harvesting land base determination

	Area (ha)			Volume (m^3)		
	Schedule A	Schedule B	Total	Schedule A	Schedule B	Total
Total area (incl. fresh water)						
Non forest						
Non-productive forest						
Total productive forest						
Less:						
Inoperable/inaccessible						
NC (Non-commercial)						
Low site						
Non-merchantable						
Non-timber resources						
e.g. ESAs						
e.g. Riparian reserves						
e.g. winter range						
e.g. other						
Specific geographically defined areas						
Unclassified roads, trails and landings						
Total reductions to productive forest:						
Volume reductions (if any)						
Total reduced land base (including ???ha of NSR)						
Additions to reduced land base:						
e.g. species conversion						
Timber harvesting land base						
Less:						
future roads, trails and landings						
Long term land base						

Please include "Schedule C" lands where they exist.

Note: Boundary revisions since the last timber supply analysis must be accounted for in the total land base. Please explain and quantify the revisions here, if applicable.

For each category in the following sections, document the total area in the TFL classified as belonging in the category (including overlapping categories that were deducted earlier in the land base reduction process) and the area that is deducted in the timber harvesting land base determination table (excluding overlapping areas that were deducted earlier in the land base reduction process).

6.1.2 Age class distribution

In Table 4 provide the age class distribution for the TFL.

Table 4. Age class distribution

Age range	Productive area (ha)			Timber Harvesting Land Base (ha)
	Productive	Inoperable	Operable	
e.g.0				
1-20				
21-40				
e.t.c.				
Total				

6.2 Total area

The total area of the TFL must be documented here (including fresh water, excluding salt water).

6.3 Non-forest

Non-forest includes fresh water, snow, ice, rock, alpine, classified roads, camps, etc.

Table 5. Non-forest area

Description	Total Area (ha)
e.g. fresh water	
e.g. classified roads	
Total	

6.4 Non-productive forest

If non-productive forest has been classified in the inventory, include the area information here.

6.5 Inoperable/inaccessible

The purpose of this section is to describe the criteria that are used in defining "inoperable" areas (i.e. areas that are not available for timber harvesting because the terrain is not conducive to timber harvesting (e.g. the terrain is too steep or road access is impossible and the flight distance renders helicopter yarding uneconomic). Some licencees may have classified areas as physically inaccessible to timber harvesting and then used stand attributes from the inventory that are related to the economics of timber harvesting to further reduce the land base to the currently physically and economically operable land base. Whatever the method used, it should be described here in detail with the appropriate reductions applied in the timber harvesting land base determination table. Classification by harvest method will be covered in more detail in section 10.3.2.

Table 6. Inoperable land base

Criteria (include detailed description below if this space is not sufficient)	Total area (ha)	Reduction area (ha)
e.g. physically inaccessible		
e.g. classified as inoperable on inventory file		
e.g. no access with current technology		
Total		

Note: Specific areas, such as inaccessible watersheds, should be identified here and excluded from the land base.

Method used to delineate inoperable/inaccessible areas:
e.g., field mapping transferred onto GIS.

6.6 Non-commercial cover

The purpose of Table 7 is to specify the amount of non-commercial cover that exists on the TFL. Timber production on these areas is considered to be unlikely. They may, for example, support non-commercial brush species. If species conversion is occurring on these sites, the management details should be documented in section 8.8.4.

Table 7. Non-commercial cover

Description	Total area (ha)	reduction area (ha)
e.g. NC brush		
Total		

Note: total area refers to the entire area covered by this classification including other, overlapping classifications

Note: Where relevant, describe areas with identifiable differences.

6.7 Low site

The purpose of Table 8 is to document the area that is not suitable for timber harvesting due to its low timber growing potential (i.e. site quality).

In some cases, minimum diameter limits and/or volume per hectare limits are set in conjunction with minimum site index limits. These must be documented in Table 6.14, problem forest types.

The "area removed" reported in Table 7 should equal the low site reduction reported in Table 3.

Table 8. Low site

Leading Species	Site Index Upper Limit	Diameter at Breast Height (cm) at Upper Limit of Low Site	Volume/ha (m^3/ha) at Upper Limit of Low Site	Total Area (ha)	Area (ha) removed	Volume (m^3) Removed	Average Volume/ha (m^3/ha) Removed
Total							

Note: total area refers to the entire area covered by this classification including other, overlapping classifications

Note: "Upper" limit applies to the area that is not suitable for harvest. For example: all areas with a site index of less than 15 are not suitable for harvest due to low site quality.

Description:

Describe the process followed in determining the low site reduction. If site class mid-points are used, document the range of the site classes removed.

6.8 Environmentally sensitive areas

Some forest lands are environmentally sensitive and/or significantly valuable for other resource uses. In the past these areas were identified and delineated during a forest inventory and called environmentally sensitive areas (ESAs). The ESA system uses the following categories: soil (Es), forest regeneration problems (Ep), snow avalanche (Ea), recreation (Er), wildlife (Ew), water (Eh) and fisheries (Ef). Two ESA categories are recognised: high and moderately sensitive.

ESA inventories are gradually being replaced by more detailed and current inventories of forest resources. Nevertheless, for some areas and resources the ESA inventory still constitutes the best available information.

In the context of timber supply analysis, ESAs may result in a reduction in harvesting opportunity on these sites. Two strategies to account for this are: percent area reductions, and the more site-specific evaluation of individual ESA polygons to determine if they should be excluded from the timber harvesting land base.

This section documents the areas that are not available for timber harvesting because they are environmentally sensitive. Table 8 will include areas that were identified as sensitive under the ESA classification system and that were not replaced using a more current and rigorous process. Examples of some more current classification systems follow this section.

Other identified non-timber resources that are not listed in this guide and for which a land base reduction most appropriately reflects management objectives must also be documented in the IP in a similar format to those used below.

The total operable area reduction reported here should equal the ESA reduction reported in Table 3.

Table 9. Area reductions for ESAs

ESA Category	ESA Description	Total Area	% Reduction	Area (ha) Reduction		
				Operable	Inoperable	Total
e.g. Er1						
e.g.Er2						
Total						

Note: total area refers to the entire area covered by this classification including other, overlapping classifications

Indicate if the ESA inventory conforms to current MOF standards and explain any differences.

6.9 Riparian reserves and management zones - streams

If a comprehensive stream classification inventory is available for all or a portion of the TFL, the area of reserve zones must be calculated in accordance with Table 1 (page 14) of the *Riparian Management Area Guidebook* and excluded from the land base.

Where a stream inventory has not yet been completed for the entire management unit, the area in the riparian reserve zone must be estimated. For example, if local information is available (e.g. surveys of average stream density distribution by class or comprehensive stream inventory of watersheds that are representative of general conditions on the TFL) it may be used to estimate reserve zone areas. Please provide a detailed description of the procedures and assumptions used to compile local estimates. These procedures should be developed in consultation with (and with the agreement of) local MoE staff.

If gullies cover sufficient area to warrant additional land base reductions (in addition to riparian reserves) the method used to identify the gullies, the management strategies and the area affected must be documented in the IP. The format should be similar to the example Table 10 below.

Management practices within the riparian management zone may be reflected in the analysis using several methods. For example, a land base reduction may be employed where the management zone width is reduced using the maximum overall retention percentages documented in Table 4 of the *Riparian Management Area Guidebook* and added to the riparian reserve zone width. Alternatively, where the reserved trees will be replaced with other trees in future harvesting, a volume reduction or a forest cover requirement may be employed.

Current performance in riparian management zones should be reviewed, and in the base case the method that best reflects this performance should be used. Note that while stems may be retained in the riparian management zone, if they do not meet the minimum diameter of trees that are reflected in the yield tables, no accounting should be made for them in the analysis.

In the information package describe in detail the methods used to account for riparian reserve and management zones in the base case and sensitivity analyses.

Table 10. Riparian reserve zones - streams

Location (e.g. zone)	Riparian Class	Stream Length	Reserve Width	Reserve area (ha)	Management Zone Width	Reduction Percent	Management zone area (ha)	Total area deducted (ha)

Information Source:

6.10 Riparian reserve zones - wetlands and lakes

Wetlands and lakes should be identified in accordance with the Riparian Management Area Guidebook pages 20 to 28. Tables 2 and 3 of the guidebook must be used to determine the area within the reserve zone.

Licensees will have varying levels of information available for use in the analysis. Please provide a detailed description of the information that is available and how it was used to arrive at the land base reductions for wetland and lake reserve zones.

For the Kamloops, Nelson and Prince George Forest Regions, Lake Classification and Lakeshore Management Guidebooks are available. Base case assumptions pertaining to the management of lakeshores should be developed considering the guidance provided in these guidebooks.

Table 11. Riparian reserve zones - wetlands and lakes

Location (e.g. zone)	Riparian Class	Length of outer edge	Reserve Width	Reserve area (ha)	Management Zone Width	Reduction Percent	Management Zone area (ha)	Total area deducted (ha)
	e.g. W1 e.g. L2							

Information Source:

Description of procedure used to estimate wetland and lake riparian reserve and management zone areas:

6.11 Wildlife habitat reductions

Wildlife habitat may be identified and managed through several processes including the *Identified Wildlife Management Strategy*, identification and approval of Ungulate Winter Range, and management practices specified in higher level plans.

For many TFLs wildlife habitat that is sensitive to timber harvesting is identified in the ESA inventory. This inventory is gradually being replaced with more detailed and current habitat mapping. Where no new, up-to-date habitat mapping is available, the ESA inventory often constitutes the best available information for the TFL, is being used in forest development planning and should be used to reflect current performance in the base case of the timber supply analysis.

When preparing the IP, the licensee should consult with local Ministry of Environment and Ministry of Forests district staff as well as the Timber Supply Forester so that any new information or policy relating to management of wildlife is identified and available for consideration in the timber supply analysis.

Where the habitat occurs over broad geographic areas, land base reductions and/or forest cover requirements may be most appropriately used to model management objectives. The source of the habitat information and the reasons for applying a land base reduction must be documented in Table 12 below. Application of forest cover requirements will be covered under section 10.2.

Table 12. Estimates for wildlife habitat no harvest areas

Identifying variables (Location descriptors)			Wildlife species	Total area (ha)	percent reduction	Excluded area (ha)

Information source:

Description of procedure used to estimate wildlife habitat no harvest areas:

6.12 Cultural heritage resource reductions

A cultural heritage resource is an object, the site, or the location of a traditional societal practice that is of historical, cultural or archaeological significance to the province, a community, or an aboriginal people. Cultural heritage resources include archaeological sites, structural features, heritage landscape features and traditional use sites. When these are known, the areas and appropriate protection or management measures must be described in this section. Current practices for protecting these areas must be reflected in the base case assumptions.

Table 13. Cultural heritage resources

Identifying variables (location descriptors)			Total area (ha)	Percent reduction	Excluded area (ha)	Reason for exclusion

Information source:

Description of procedure used to estimate cultural heritage resource areas:

6.13 Other sensitive site reductions

Any other areas that are identified as sensitive to timber harvesting, for which land base reductions most appropriately reflect management objectives and that are not covered under the preceding sections, must be documented in the IP. The source of the information used, the area affected, and the methods used for modelling must be discussed in the IP.

If more current information for sensitive sites that were traditionally identified as ESAs is available, the more current information should be used in the analysis along with modelling methods that properly reflect the management objectives. For example, if a terrain stability classification has been completed, this information should be used in place of soils ESAs.

Table 14. Other sensitive site reductions

Type	Total area (ha)	Percent reduction	Excluded area (ha)	Description
Total				

Information source:

Description of procedure used to estimate other sensitive site reductions:

6.14 Problem forest types

Problem forest types are stands that are physically operable and exceed low site criteria yet are not currently utilised or have marginal merchantability. These types are wholly or partially excluded from the timber harvesting land base. Examples are balsam, cedar and hemlock stands that contain a high proportion of decadent wood, pine stands with a very high stand density, and deciduous (hardwood) stands.

The purpose of Table 15 is to document the areas that are currently considered to be problem forest types. The land base reductions are usually described according to inventory file attributes (e.g. type group, site index breaks, age, height, stocking, minimum volume per hectare and/or minimum average stand diameter).

Table 15. Problem forest types

Zone/Group	Inventory Type group	Characteristics						
		e.g. Age	e.g. Height	e.g. Stocking	Total area (ha)	Reduction percent	Area deducted (ha)	Area remaining (ha)

Information source and comments:

Note: Where deciduous species cover a significant area and/or where harvesting of deciduous species is an issue, deciduous should be covered under a separate heading. In any case, explain how deciduous reductions are modelled. (e.g., do reductions pertain to leading deciduous species types only or to reductions to conifer/deciduous yield tables, etc.).

6.15 Roads, trails, and landings

The purpose of this section is to quantify the area that is, and will be, disturbed by roads, trails, and landings. This area is expected to remain non-productive unless all or part of it is permanently deactivated (returned to its original condition). Plans for road deactivation and methods used to model this activity must be included in this section.

Deactivation plans and modelling methods:

6.15.1 Classified roads, trails, and landings

Table 16 describes areas that are currently classified in the inventory as roads, trails, and landings. Usually this area is included in the non-forest land base reduction (see section 6.3). The information presented here should include a breakdown of the area in each disturbance category (i.e. roads, trails, landings). This information may assist in providing estimates for unclassified and future roads, trails and landings.

Table 16. Classified roads, trails, and landings

Location	Total area (ha)		
e.g. zone e.g. group	roads (ha)	trails (ha)	landings (ha)
Total			

Information source:

6.15.2 Unclassified roads, trails, and landings

The purpose of this section is to document the area that is occupied by roads, trails and landings that is not classified in the forest cover inventory. The source of the information and method used to estimate this reduction must be documented in the IP.

In some areas it may be warranted to localise the reductions to broad age classes or zones or groups. For example, large unroaded fire origin immature areas should not have existing road reduction percentages applied. Conversely, access to cutblocks often run through old growth areas where a land base reduction may be warranted.

For all road reductions the road length and width (often by road class or category) used to estimate the area must be provided. The criteria used to determine road width need to be described. Sufficient information must be provided to allow easy review and validation by Forest Service staff of this land base reduction.

The method used to derive landing area estimate must also be described.

If road deactivation (re-contouring) is current practice, information detailing roads deactivated in the past and projected to be deactivated in the future should be included in the IP and accounted for in the analysis. The method, or the information source used to derive a productivity reduction for the area of restored roads must be described.

Table 17. Road classification

Road class	Road length (km)	Road width (m)	Area (ha)

Table 18. Unclassified roads, trails, and landings

Location	Total area (ha)			Deactivated area (ha)				
e.g. zone e.g. group	roads (ha)	Trails (ha)	landings (ha)	roads (ha)	trails (ha)	landings (ha)	Reduction percent	area deducted
Total								

Information source:

Method used to estimate area or percent reduction:

6.15.3 Future roads, trails, and landings

Table 19 includes the area of all roads, trails, and landings that will be constructed in currently undeveloped areas (mature and immature).

The reduction may be applied as a percent reduction equally against all stands that will be disturbed in the future, or as an area reduction to each analysis unit, zone, group, broad maturity class or specific area.

If there are no plans to deactivate roads and restore them to some productive capacity, stands will provide harvest volume on the first entry but not on further entries. Plans for deactivation should only be included in the base case if a road deactivation program is currently in place on the TFL. Road deactivation performance information should be provided to support the modelling assumptions.

The method, or the information source used to derive a productivity reduction for the area of restored roads must be described.

The area contributing to the long term harvest level is net of the area that will be covered by roads in the future.

Table 19. Future roads, trails, and landings

Location	Total area (ha)			Deactivated area (ha)				
e.g. zone e.g. group	roads (ha)	trails (ha)	landings (ha)	roads (ha)	trails (ha)	landings (ha)	reduction percent	area deducted
Total								

Information source:

Method used to estimate area or percent reduction:

6.16 Exclusion of specific, geographically defined areas

The purpose of this section is to document the location and total area to be excluded from the timber harvesting land base to account for any area-specific exclusions that are part of current forest management. This reduction includes, for example, parks or wilderness areas designated by Order-In-Council that are not already accounted for on the inventory file.

While areas recognised in legislation or by Order-In-Council as not contributing to the timber harvesting land base may be excluded, areas which have been deferred from harvesting because they are contentious or are under study (e.g. planning deferrals, potential parks) should not be considered unavailable for timber harvesting in the base case. The ramifications of these potential land base reductions may be explored in other timber supply options or sensitivity analyses.

Table 20. Exclusion of specific, geographically defined areas

Identifying variables (Location descriptors)			Excluded area (hectares)	Reason for exclusion

Information Source:

Method used to estimate area reduction:

6.17 Any other land base exclusions

The purpose of this section is to specify the location and total area to be excluded from the timber harvesting land base for any other resource concerns that are most appropriately accounted for through land base reductions. The information source and the method used to estimate the area, as well as any other information that is pertinent to modelling these assumptions, must be included in the IP.

6.18 Area additions

The purpose of this section is to document areas that are added into the timber harvesting land base immediately or at some time during the forecast period. A common example of this is the regeneration to conifers ("rehabilitation") of areas that were deducted in Table 3, Timber Harvesting Land Base Determination, as non-commercial cover.

Table 21. Area additions

Reason for area addition	Analysis unit	Timing of addition	Area (ha)
Total			

Information source:

Method used to estimate area addition:

7 Inventory aggregation

7.1 Management zones and multi-level objectives (groups)

This section describes the criteria and rationale used in delineating areas that are subject to unique forest cover objectives (e.g. areas with specific forest cover objectives to satisfy wildlife habitat, visual quality objectives, biological diversity requirements etc.). In most management units, specific areas may be subject to one or more (or no) overlapping forest cover objectives. The actual forest cover constraints applied are discussed under section 10.2, Forest cover requirements.

In order to approximate multi-layer objectives the following approach was used in the Forest Service model FSSIM. The entire management unit area must be covered by one or more unique, mutually exclusive zones. Each of these zones may be subject to a maximum disturbance, a minimum older forest or no forest cover requirement. For example, these constraints are suitable for modelling visual quality objectives and wildlife habitat objectives.

In addition to the zonal level of constraints, additional levels may be applied to any or all areas of the unit. This function of the model provides complete flexibility in combining any areas on the inventory input file ("groups" in FSSIM terminology) and subjecting them to constraints such as forest cover requirements, area harvest targets and volume harvest targets. This level of constraints is suitable, for example, for modelling landscape level biodiversity requirements and harvest targets in problem forest types.

Other models used in BC will likely use a different approach with similar results. Due to the increasing amount and complexity of the information that will be generated from timber supply models, it is essential that the procedures used and the information generated is clearly documented and explained in the IP and timber supply analysis report.

Table 22. Zones and groups

Zone/ Group	name	total area	net area	Criteria used to delineate zone/group				Rationale/ Comments
zone 1	e.g. VQO partial retention			e.g. Highway corridor e.g. all polygons classified as P R. VQO				e.g. mapped by _____ as per regional/provincial landscape guidelines dated June 30/92
zone 2	e.g. Deer			e.g. Fir leading	e.g. ≥age class 4			e.g. regional/habitat guidelines dated Dec. 31/91 were followed
zone 3	e.g. Normal Management			e.g. all areas not covered by other zones				e.g. normal management included 4 pass system with 15 year green-up to account for adjacency constraints
group 1	e.g. Caribou			Caribou area				e.g. instructions in letter from MoE, regional habitat biologist, dated Feb. 14, 1993, were followed
group 2	e.g. landscape unit 1			Koch creek watershed				

Note: See Section 10.2, Forest cover requirements.

Information source:

Method used to delineate zones and groups:

7.2 Analysis units

In order to reduce the complexity and volume of information used and generated in timber supply models, individual stands may be aggregated into fewer, larger, and more or less homogeneous units called analysis units. They are usually comprised of combinations of stands with similar tree species, timber growing capability (site index) and sometimes silvicultural management regimes. Yield tables representing the growth of trees on each polygon within the analysis unit are combined to represent the area weighted average growth of stands on the unit. Yield tables for currently existing and future regenerated stands are developed using this method.

In some cases it may be warranted to assign analysis units to specified age ranges for a given species/site class combination. For example, when the site index assigned to old growth stands in the inventory does not reflect the growth potential expected for thrifty stands, analysis units may be created for each of the old growth and thrifty components of the species/site range combinations.

It may also be warranted to create separate yield tables for similar analysis units in different zones in which they occur. For example, analysis unit fir good in zone A may consist of areas with an average site index that is lower than analysis unit fir good in zone B. For this reason it may be preferable to define two analysis units for fir good, one for zone A and one for zone B.

Please describe in detail the methods used and reasoning behind the aggregation of the inventory into analysis units. It may be necessary to provide several tables to describe

analysis units for mature stands, thrifty stands, existing managed stands and future regenerated stands.

Table 23. Analysis units

Zone/ group	Analysis Unit (# and Name)	Net Area	Site Index	Variable used to define Analysis Unit				Rationale used or Comments[1]
	e.g.			Species/ Type Group	Site index range	age range	etc.	
e.g. VQO partial retention	1) S/F GMP 2) Pl GM 3) Pl P			S/F	G (SI 35+)			
e.g. Wildlife	4) S/F GMP 5) Pl/ GMP 6) C/H GMP							
e.g. Caribou	7) All						entire Caribou Zone	
e.g. Normal Management	8) S GM 9) S P 10) F GM 11) F P 12 Pl GMP 13) C/H GMP							

Information Source:

Description of methods used:

7.3 Detailed land base information requirements

Please provide the Timber Supply Forester with the detailed inventory file (digital ASCII format) created after the determination of the timber harvesting land base for the base case. This file will include polygon specific information on both the area within the timber harvesting land base and the area deducted from the total land base to arrive at the timber harvesting land base. This information will enable the Timber Supply Forester to review the land base reductions applied.

For the base case provide the Timber Supply Forester with all the timber supply model input and output files (digital ASCII format).

All files must include detailed field descriptors.

Similar information to the above for other options or sensitivity analyses may be requested by the Timber Supply Forester should she/he consider it necessary to gaining a better understanding of the timber supply on the TFL.

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[1] The rationale used to define the analysis unit may be obvious based on the variables that were used to define each analysis unit. This column should contain, for example, descriptions of areas that do not fit the criteria of the analysis unit but were aggregated into the analysis unit due to the small size of the area.

The Timber Supply Forester may generate reports from the files provided or request summary reports from the licensee to provide Forest Service field staff with information they may need to provide effective input into the evaluation of the IP.

8 Growth and yield

This section will be forwarded to Resources Inventory and Research Branch staff for their review and acceptance. Acceptance of the growth and yield information is a requirement and must be obtained before proceeding with the analysis.

8.1 Site index

8.1.1 Site curves

Describe the site curves used for all species and age groups.

Table 24 Site index source

Species	source
e.g. Amabilis fir	Kurucz (1982)

If any site index curves are not the accepted Ministry of Forests' standard, please explain the rationale for using alternate curves. Alternate curves must be accepted by Research Branch staff.

8.1.2 Site index adjustments

Any adjustments to old growth site index (e.g. paired plot, vet study, SIBEC) in the base case, an option or a sensitivity analysis must be explained in detail. Adjustments to old growth site indexes in the base case must be accepted by Research Branch staff. The methods used and the magnitude of old growth site index adjustments for another option or sensitivity analysis should also meet with Research Branch staff's approval.

Table 25 Site index adjustments

Species	Age range	Inventory site index	Adjusted site index	area (ha)
e.g. Fd	0-30 31-140 140 +	 12 e.g. 12	 12 e.g. 15	

Information source and methods used:

Provide a detailed description of the information source and methods used.

8.2 Utilization level

The utilization level defines the maximum height of stumps that may be left on harvested areas, and the minimum top diameter (inside bark) and minimum diameter at breast height by species of stems that must be removed from harvested areas. These factors are needed to calculate merchantable stand volume for use in the analysis. The level documented here is the utilization level currently applied in operations. Please include the firmwood standard where it is not equal to 50%.

Table 26. Utilization levels

Species	Utilisation			
	Minimum dbh (cm)	Maximum Stump Height (cm)	Minimum Top dib (cm)	Firmwood standard (%)

8.3 Decay, waste and breakage for unmanaged stands

Table 27 documents the decay, waste and breakage factors by species that are applied to unmanaged stand yield tables to obtain net volumes per hectare.

These factors should be derived using Ministry of Forests' procedures. If they are not standard Ministry of Forests' loss factors, please provide a detailed explanation of how they were derived.

Decay, waste and breakage factors must be approved by Resources Inventory Branch staff in conjunction with the review of the unmanaged stand yield tables. Contact Resources Inventory Branch, Growth and Yield Section, to discuss proposed methods of determining factors and information requirements for the review of the proposed factors.

Table 27. Decay, waste and breakage factors for unmanaged stands

FIZ	PSYU or local	Utilisation level (cm dbh)	Age range	Factor by species (%)				
			<80, 81-120, >121	F	C	H	B	→ etc.

Table 28. Sources of decay, waste and breakage factors

Factor	Species	Source

8.4 Operational adjustment factors for managed stands

In this section, describe all operational adjustment factors (OAF) that need to be applied in order to reduce potential yields generated by growth and yield models (e.g. TASS) to operational yields.

Please include the following information:

- the magnitude of each factor;
- the yield table to which each factor applies;
- the components that make up each factor;
- the source of the factors; and
- data to justify the magnitude of the factors (if not the accepted MoF standard).

Note that the Resources Inventory Branch of the MOF is currently developing a stand level decay model that will be available for use with the managed stand yield tables. When this model is available, one or both of the standard OAFs discussed above may be modified or replaced by information generated from the decay model.

This information must be reviewed and accepted by Research Branch staff in conjunction with the managed stand yield tables.

8.5 Volume reductions

Table 29 documents other volume reductions by species, such as reductions to existing stands where they are deemed to be excessively decadent, or where a species will not be harvested in mixed stands (e.g. deciduous, larch in a spruce larch stand).

Table 29. Volume reductions

e.g. Leading species e.g. Analysis unit e.g. Type group	Problem species	Volume (m3/ha)	Percent (%)
Total			

Explain how this reduction is modelled.

8.6 Yield table development

This section details the methods used to produce the yield tables that will be used in the timber supply model to represent timber yield over time for each analysis unit. These may be derived by generating yield tables for each polygon and area weighting them to form an aggregate table. Another method is to area weight the attributes used in generating yield tables and use the resulting attributes to produce the aggregated yield tables. Whichever method is chosen, it must be clearly described to facilitate the review by Forest Service staff.

Methods used:

Note: All yield tables, must be included as an appendix to the final analysis report. They must also be submitted in digital form to facilitate the review of the analysis.

8.7 Yield tables for unmanaged stands

The following sections describe the source and methods used to develop yield tables for unmanaged stands. These yield tables will be reviewed and must be accepted by Resources Inventory Branch staff prior to proceeding with the analysis.

8.7.1 Existing mature timber volumes

The purpose of this section is to describe how existing mature timber volumes (old growth) are derived.

Age Class (or age): e.g. > age 140

Description: e.g. existing mature (old growth) timber volumes are derived from the yield tables for each analysis unit.

e.g. existing mature (old growth) timber volumes are derived using area weighted inventory plot volumes for each analysis unit.

8.7.2 Yield tables for unmanaged immature stands

This section describes the methods used to develop yield tables for currently existing and future regenerated unmanaged stands. These tables may be developed differently for different age ranges, depending on the detail of information available in the inventory.

Please describe in detail the source of the information, the growth and yield model and the methods used to derive these yield tables.

Source:

Methods used:

8.7.3 Existing timber volume check

In order to verify that no errors were made in aggregation and that no significant aggregation bias exists, the total volume of the current (starting) inventory using polygon specific volumes should be compared to the total volume of the current inventory using analysis unit volumes. If the difference seems unreasonable, the aggregation methods should be reviewed to determine the cause of the difference.

Please describe in detail the methods used to calculate the total inventory volume using polygon specific information and analysis unit information. Table 30 may be expanded to show more detailed information such as volume by age class or by analysis unit and age class.

Table 30. Existing timber volume check

	Polygon volume derived using:		% difference
	Inventory volume	Yield table (AU) volume	
Total volume (m3)			

8.8 Yield tables for managed stands

The following sections describe the source and methods used to develop yield tables for managed stands. These yield tables will be reviewed and must be approved by Research Branch staff prior to proceeding with the analysis.

8.8.1 Silviculture management regimes

The purpose of this section is to describe in detail how the yield tables are developed to reflect each silvicultural management regime within an analysis unit. When reviewing the growth and yield information submitted here and in Appendix I, Research Branch growth and yield staff may attempt to recreate the proposed yield tables. Sufficient information must be included in this IP to enable them to accomplish this.

Silviculture performance information must be provided to support the management regimes that will be modelled in the base case.

Table 31 is an example of the kind of information that is required. Note that site index assignment for each species is described in Section 8.1.

Table 31. Silviculture management regimes

Analysis Unit	Area (ha)	Leading Species	Second species	Weighting (%)	SI	Establishment Density (stems/ha)		Regeneration delay		Management	
Number/ name						natural	planted	natural	planted	e.g. Spacing (stems/ha @ age)	
e.g. 1		Fd	Cw	80/20	27	3000	1600		2	750 @ 20	
										750 @ 20	

Information source and description (e.g. growth and yield model used):

Methods used:

8.8.2 Regeneration delay

Regeneration delay is the time elapsed between harvesting and the establishment of a new stand of trees. The end of the regeneration delay is time zero for a yield table; it is the point in time when stand growth begins. The age of the seedling should be included in the estimate of regeneration delay. This may be accomplished either in the growth and yield or the timber supply model, however care must be taken not to double count the age of the seedling.

This section describes the source of the regeneration delay information included in Table 31, above.

Regeneration delay must be included in the time elapsed before the required green-up condition is attained that allows harvesting of adjacent areas. This will be covered in more detail under section 10.2, forest cover requirements.

Source of information:

Describe how the regeneration delay is applied (e.g. in the yield tables, in the timber supply model, etc.):

8.8.3 Regeneration assumptions

This section describes how analysis units are regenerated after harvesting (i.e., to which analysis unit (or yield table) is each area regenerated following harvest). Table 32 is an example of the kind of information to be included in this section.

Often areas currently covered by one tree species are planted to another species after harvesting. On the same area, the site index for one species is usually different than the site index for another species (contact Dr. Gordon Nigh at MOF Research Branch for further information). If species conversion is occurring, the method used to adjust the site index for each species must be described in detail.

Table 32. Regeneration regime

Existing Analysis Unit	Regenerated Analysis Unit(s) percent allocation					
Name/number	BG/101 (n)	BG/102 (p)				SG/109 (p)
Bl Good/1	25	25				50
S Good/9						100

Describe the modelling methods used when applying the regeneration assumptions:

Describe site index changes associated with species conversions. Include the site index conversion equations, the converted site index and the site index of the analysis unit to which the existing analysis units are being regenerated.

8.8.4 Stand rehabilitation

The purpose of Table 30 is to document how the conversion of non-merchantable or less desirable forest types (e.g., deciduous, stocking class 4 Pl, etc.) to merchantable forest types will be modelled.

Table 33. Stand rehabilitation

Existing analysis unit	Total area (ha)	% to be treated	Area to be treated (ha)	Conversion schedule (ha/decade[1])						Analysis unit regenerated to	Yield table regenerated to	Site index change[2]
				1	2	3	4	5	6			

Provide an account of the history of species conversion on the tree farm licence, including area treated and rate of treatment (i.e., ha/year).

Describe in detail the methods and attributes used in generating these managed stand yield tables.

[1] Provide the area that will be converted each decade. If species conversion is modeled differently, provide a detailed explanation of the methods used.

[2] Document the site index change (if any) in converting from the existing analysis unit to the regenerated analysis unit. Provide documentation that proves that the site index change actually occurs. This information will be reviewed by Research Branch staff.

8.8.5 Genetic improvement

In this section describe the application of yield adjustments to account for the use of genetically improved planting stock.

Include an account of the historic and current use of genetically improved stock on the TFL. Describe the availability of the improved stock for the TFL and the likelihood that it will be available in the future (e.g. list any seed orchards owned by the licensee or agreements with seed orchards to obtain improved stock over time).

Describe in detail how the genetic worth is applied in the yield tables or the timber supply model (e.g. applied in TIPSY or as an OAF or as a site index adjustment).

Describe when during the forecast period genetic gains will be applied and provide justification for the timing.

Table 34. Genetic worth

		Genetic worth	
Species	Seedlot number	1st generation	2nd generation

Description/justification:

Methods:

Note: the genetic worth of each seedlot can be obtained from the Forest Genetics Section at Research Branch.

8.9 Silviculture history

8.9.1 Existing managed immature

The purpose of Table 35 is to document, for each analysis unit, the area by age class of existing managed second growth stands within the TFL.

Table 35. Immature management history

Analysis Unit		e.g., Natural (ha) Age Class			e.g. Planted (ha) Age Class			e.g. spaced (ha) Age Class			Total Area (ha)
#	Name	1	2	3	1	2	3	1	2	3	
1	FG										
2											
3											

Note: Add further age classes if required.

Explain how these stands are accounted for in the analysis (i.e. are they grown on MSYTs? How was site index assigned?). Assumptions made in the analysis about the history of management on the TFL must be supported with evidence (i.e. performance statistics).

Comment on current silviculture management performance relative to any silviculture treatments applied in the managed stand yield tables used in the base case.

8.9.2 Backlog and current non-stocked areas (NSR)

Backlog NSR is any area that was denuded prior to 1987 (when basic silviculture became the obligation of the licencees) and is not yet fully stocked. All other NSR is current NSR.

Table 36 documents the areas in the timber harvesting land base that are backlog and current NSR and specifies how and when these areas will be regenerated.

Table 36. Backlog and current NSR

Original Analysis Unit	Analysis Unit Regenerated to	Backlog NSR		Current NSR		Total Area (ha)
		Area (ha)	Years until Stocked[1]	Area (ha)	Years until Stocked	
1						
2						
Total						

[1] This column could alternatively be titled "Rate of restocking (ha/decade)" or "Regeneration Schedule" with the column subdivided into decades.

Note: If inoperable NSR exists on the TFL, please include a similar table describing this area and discuss plans for management if any.

Provide an account of the history of Current and Backlog NSR area regeneration, including the area regenerated each year.

Describe the method used to assign site index to the NSR area.

Describe the logic used when assigning NSR to analysis units.

Describe in detail how and when NSR is regenerated in the timber supply model. What age is assigned to NSR areas in the model?

9 Protection

9.1 Unsalvaged losses

This table quantifies unsalvaged (timber) losses occurring due to natural causes. It includes epidemic losses to insects and disease, and losses to fire and blowdown. When modelling timber supply, the unsalvaged losses estimate is usually added to the desired harvest requested for each decade and then subtracted from the forecast upon completion of the modelling exercise.

Unsalvaged losses have generally been applied as a factor covering the entire unit. While often no better information is available, where it is, unsalvaged losses may be applied on a location specific and/or species specific basis.

Since unsalvaged losses are applied over the long term, the average loss should be derived from long term historic data. The objective is to include in the average annual estimate, events that are known to occur periodically (e.g. 50 year storm events).

Unsalvaged losses estimates should be derived from local information, and not taken from assumptions made for adjacent management units.

Table 37. Unsalvaged losses

Location (zone, analysis unit)	Cause	Gross Losses (m^3/year)	Volume Salvaged (m^3/year)	Unsalvaged Loss (m^3/year)
	Fire			
	Insects (Epidemic)[1]			
	Disease (Epidemic)[1]			
	Windthrow			
	Other			
Total				

Describe how the unsalvaged loss figures were derived (e.g. time frame, major outbreaks included, etc.).

Include information detailing the extent of salvage operations.

[1] Endemic losses are reflected in the yield tables.

10 Integrated resource management

10.1 Forest resource inventories

During the term of each management plan information and policies may change. As a result it seems reasonable to review and sometimes change the inventory information available for the timber supply analysis, including information that was deemed to be adequate for the last timber supply analysis. Having each of the inventories reviewed and accepted by the appropriate agencies prior to submitting the information package often reduces the number of questions and changes to the package requested by the agencies.

The purpose of this section is to document the status of all forest resource inventories. Indicate what standard was used to complete each inventory, the date of completion or update, and approvals obtained.

Table 38. Forest resource inventory status

Forest Resource Inventory	Standard	Date completed/ updated	Date approved	Approved by	Status
e.g. Landscape					
e.g. Recreation					
e.g. Range					
e.g. ESA					
e.g. Stream					
e.g. Wildlife					
Other					

Note: If more space is required to explain standards, etc., please change the format to include the information.

10.2 Non-timber forest resource management

10.2.1 Forest cover requirements

Management strategies for specific forest resources can often be expressed in terms of maintaining a desired age distribution of the forest cover. For example, stands on harvested areas must have aged to meet and surpass a critical green-up age before adjacent stands may be harvested. Forest cover requirements may also be applied to

ensure that a portion of an area is covered with stands older than a certain age (e.g. to maintain old growth) or with stands within a specific age range (e.g. to maintain thermal cover for wildlife).

It may be necessary or desirable to manage for two or more different forest related resources on the same area. As noted in section 7.1, currently available timber supply models are designed to account for overlapping forest cover constraints. For example, landscape unit level old seral objectives may overlap portions of areas where visual impacts will be managed.

With the requirement to retain different forest characteristics across the landscape, it is important to identify if productive forest outside of the timber harvesting land base might contribute to the area needed to satisfy a forest cover requirement (i.e. maximum allowable disturbance or minimum area retention).

Forest cover requirements may be expressed as follows:

- a maximum area (or percent area)(THLB or productive) that may support stands younger than age X (or shorter than height Y).
- a minimum area (or percent area)(THLB or productive) that must support stands older than age W (or taller than height Z).
- a minimum area (or percent area)(THLB or productive) that must support stands between age U and age W.

If necessary, all types of forest cover requirements may be applied at the same time to the same zone, group or analysis unit.

Some common forest resource values for which management can be expressed in terms of cover requirements are: Visual resources, ungulate winter range, landscape unit level biodiversity objectives, and green-up requirements for cutblocks before adjacent cutblocks may be harvested.

10.2.1.1 *Green-up*

Age to green-up can impact harvest-scheduling opportunities based on minimum green-up height requirements as identified in the Forest Practices Code of British Columbia Act (as outlined in the Operational Planning Regulation section 68). The age to green-up is an important operational scheduling parameter and a key element in timber supply analysis. Green-up is used as a measure of tree height and site occupancy to meet visual, hydrological, wildlife or other objectives. Achievement of green-up height is required before adjacent areas may be harvested.

Height-age curves (e.g. SiteTools) have been used for timber supply analysis to approximate the age at which green-up heights are achieved. Recently the MOF prepared

the document *Age to Green-up Height: Using Regeneration Survey Data* which should be available in July, 2000. It provides height-versus-age estimates by site index derived from data available in the Integrated Silviculture Information System (ISIS) along with a comparison of these green-up ages to those derived by Site Tools.

The information in the document should be considered for use in timber supply analyses. Where sufficient data was available (see *Age to Green-up Height: Using Regeneration Survey Data*, appendix 4) to project reliable estimates of age to green-up, and where no better local information is available, the information in the document should be used. Otherwise, site tools or similar height age relationships may be used to determine age to green-up.

10.2.2 Visual Resources

The *Procedures for Factoring Visual Resources into Timber Supply Analyses* (REC-029) were updated in March, 1998. These procedures should be consulted when determining appropriate forest cover requirements to apply for visual resources in the base case.

Usually visual resources are managed on areas that are known to be visually sensitive to disturbance. In time the intent is to "make known" scenic areas and establish Visual Quality Objectives (VQOs) for them under the Forest Practices Code throughout the province.

Currently the processes for identifying scenic areas are at various stages of completion. As described on page 3 of the "procedures", for some districts scenic areas have been made known and VQOs established by the district manager or a planning process (e.g. higher level plan). For some districts scenic areas have been made known but VQOs have not yet been established. For some the landscape inventory has been completed but no scenic areas have been identified and made known. Nevertheless, in many of these areas visual resources are being managed, in some cases in accordance with a "district manager policy" letter or commitments made in the management plan.

For the base case the legally established objectives, and/or the on the ground current performance, and/or the district manager guidance and the commitments made in the management plan must be reviewed to determine the basis upon which visual resources are being managed on the TFL. The basis for this management must be described and if possible supported with documentation in the IP (attach any relevant instruction letters as an appendix to the IP). Strategies to "buy back" timber supply must be explained and any impacts must be quantified in the analysis (i.e. by comparing the base case with a relevant sensitivity analysis).

Sensitivity analysis is warranted where uncertainty about visual resource management practices exists.

Visually effective green-up heights should be determined using the procedures described in Table 6, page 9 of the "procedures" or based on current performance (operational approvals) or on direction from a planning process or the district manager.

Table 39 is intended to describe the breakdown of the scenic area into VQO areas and the forest cover requirements that will be applied for each VQO. More detail may be required where the VQO for each visual sensitivity unit (polygon) is accounted for separately.

Table 39. Visual Resources

VQO	Productive (ha)	THLB (ha)	Green-up height (m)	Green-up age (years)	allowable denudation percent
e.g. retention			e.g. 4	e.g. 22	e.g. 5%

Please describe the rationale and method used to determine the areas and percentages documented in Table 39. It may be beneficial (and expedite the review process) to append a worksheet detailing the information (e.g. area within each visual absorption capability (VAC), methods and calculations used to derive the green-up heights and ages and the allowable denudation percent.

Where no local data for determining the visually effective green-up age is available, The Ministry of Forests publication *Age to Green-up Height: Using Regeneration Survey Data (June 2000)* should be used.

10.2.3 Recreation Resources

Recreation objectives may be identified in a higher level plan (e.g. landscape unit objectives or recreation site, trail or interpretative forest site objectives) or through the district manager making recreation features "known". Often, the best available information describing the recreation resource is the ESA inventory (see section 6.8).

Where recreation objectives are best represented in the model by the application of a forest cover requirement, please include in this section the rationale and the methods used in modelling the objectives.

10.2.4 Wildlife

10.2.4.1 *Ungulate winter range*

Ungulate winter ranges are areas that have been "identified as being necessary for the winter survival of an ungulate species". These areas may be identified through a higher level plan, the chief forester and deputy minister of Environment, Lands and Parks under section 69 of the Operational Planning Regulation, a wildlife management plan or strategy approved before October 15, 1998 by the district or regional manager and the designated environment official, the chief forester or by the ministers.

The management objective for ungulate winter range typically includes the maintenance of thermal cover and/or old growth. In the model, this may be accomplished by removing the identified area from contributing to timber supply (see section 6.11 Wildlife Habitat Reductions) or by applying forest cover requirements. Thermal cover is usually provided by stands that average a certain tree height. Thus, the forest cover requirement is expressed in terms of a minimum amount of the area identified as ungulate winter range being covered with stands that are within a certain age range, a surrogate for stand height.

In this section please describe the process that led to the identification and approval of the ungulate winter range and the rationale/method/agreement(s)/report(s) that was used in determining the forest cover requirement for winter range. Provide details on the area delineated as ungulate winter range (total, productive and THLB) and describe (in tabular format and/or text) any land base reductions and the forest cover requirement that will be applied to this area.

Where the process for identifying ungulate winter range is incomplete, the effect on timber supply of managing the ungulate winter range (based on the best information available at the time the analysis is completed) should be investigated using sensitivity analysis.

10.2.4.2 *Identified wildlife*

Identified wildlife are managed through the establishment of wildlife habitat areas (WHA) and implementation of general wildlife measures (GWMs), or through other management practices specified in higher level plans. The procedures for establishing WHAs are described in *Managing Identified Wildlife: Procedures and Measures, Volume I, February 1999*.

Three species identified in the Identified Wildlife Management Strategy are dependent on habitat requirements that cannot be managed solely through WHAs because they have large home ranges, occur at low densities, have widely and sparsely distributed limiting habitats, or are sensitive to forest level disturbances. These species are called "higher level plan species" and include bull trout, fisher and grizzly bear. Management strategies for these species will most often flow from higher level plans.

As described in section 6.11, forest management in the habitat of some wildlife species may best be accounted for in the model using forest cover requirements. In this section tabulate the identified wildlife species (including the higher level plan species) that exist or may exist on the TFL. Include the area of established WHAs and describe the GWMs that apply. Also describe any objectives or management strategies prescribed for the higher level plan species.

Often, identified wildlife species have been sighted on a management unit and current management includes protection of their habitat (e.g. Queen Charlotte goshawk nesting sites), even though WHAs have not yet been established. The licensee should discuss with MOE staff and the Timber Supply Analyst whether accounting for the management of these areas should be included in the base case or a sensitivity analysis.

Explain the methods that will be used in the timber supply model to account for these measures and tabulate the forest cover requirements that will be applied in the base case and any proposed sensitivity analyses. The information provided should include the amount of area managed for the species of concern, the location or identification of the area (e.g. zone, group), and any land base reductions, volume reductions and forest cover requirements applied. This information should be presented in a table if possible.

10.2.4.3 *Caribou*

Generally areas are identified for caribou management during the Land and Resource Management Planning (LRMP) process. This process is at various stages of completion for different areas of the province. Until the LRMP covering the TFL is completed and higher level plan objectives for caribou management are signed off, draft management strategies may be in place.

In this section describe the status of planning for caribou management. Include an account of current caribou management practised on the TFL and, if available, in an appendix provide any instructions issued by the district manager detailing her/his expectations for the management of this species.

In a table and/or text, provide information detailing the extent of the area being managed for caribou, in terms of total land base, productive forest and timber harvesting land base. Explain what forest cover requirements are deemed to be necessary and explain how these will be reflected in the base case and/or in any planned sensitivity analysis.

10.2.5 Adjacent cutblock green-up

The purpose of this section is to describe the current operational requirements for "green-up" of a cutblock before adjacent cutblocks may be harvested. To attain green-up conditions, the harvested block usually must be covered with stands of a certain height.

In the timber supply model the stand height requirement is often expressed in terms of the time needed to attain the height (green-up age). Finally, the adjacent cutblock green-up constraint (or adjacency constraint) is expressed in terms of the percentage of an area that may be covered with stands aged less than the green-up age.

The area that is subject to the adjacency constraint is that portion of the timber harvesting land base (not the productive land base) where harvesting is not otherwise constrained by non-timber resources. This area is often named the Integrated Resource Management zone or the General Forest Management zone. Areas where harvesting is otherwise constrained by non-timber resources where the constraint is less than the adjacency constraint should be included in the area subject to the adjacency constraint.

Describe the rationale/method used to determine the number of years after a block is harvested before adjacent cutblocks may be harvested and the amount of area that may be covered with stands less than the green-up age (or height).

As described in section 10.2.1.1, where no local data for determining the green-up age is available, The Ministry of Forests publication *Age to Green-up Height: Using Regeneration Survey Data (June 2000)* should be used.

If a spatially explicit model will be used for the analysis, refer to section 4 for examples of the kind of information needed to explain how adjacency issues are managed in the model. The analyst must have a thorough understanding of the function of the model and must be able to explain in detail how adjacency issues (and forest cover requirements in general) are addressed in the model.

10.2.6 Biodiversity

The *Landscape Unit Planning Guide* was released in March, 1999. It consolidates prior direction and information for biodiversity management. It presents new techniques and procedures to implement landscape unit planning and should be consulted when developing the biodiversity assumptions that will be used in the base case and sensitivity analyses. The retention of old growth and wildlife trees is the current priority for landscape unit planning.

10.2.6.1 *Landscape level biodiversity*

The intent of this section is to describe the procedures to be used for incorporating landscape units (LU) and biodiversity emphasis options into the timber supply analysis. The background section below includes excerpts from the *Landscape Unit Planning Guide*. These should be considered when developing landscape level biodiversity assumptions for the base case.

Background

Chapter six of the *LU Planning Guide* describes the process to be followed when establishing LU boundaries and objectives. Currently draft LUs, and in many cases draft biodiversity emphasis options (BEO) are in place throughout the province. In some areas LUs and BEOs have been established pursuant to section 4(1) of the *Forest Practices Code of BC Act*.

As described above, the retention of old growth is one of the two current priorities for LU planning. In accordance with the *LU Planning Guide (Chapter 3, Procedures for Preparing LU Objectives and Strategies)*, the recommended approach to developing old growth retention is through the establishment of Old Growth Management Areas (OGMA) and associated LU objectives that will ensure retention and/or recruitment of old growth structure over time.

According to step one of this process (*LU Planning Guide* p. 28), old growth targets must be met using the non-contributing land base first.

In addition, old growth representation is to be managed at the biogeoclimatic (BEC) variant level unless a Resource Management Zone objective established as a higher level plan directs representation at a finer level or the chief forester permits an exception (*LU Planning Guide* p. 28).

Where there is more than one possible location for an OGMA, choose the location that will minimize the impacts on the timber resource (e.g. use a retention VQO area prior to using a non-visually sensitive area) (*LU Planning Guide* p. 29).

In LUs with a high or intermediate biodiversity emphasis, the intent is to capture the entire old growth target in OGMAs immediately. Where there exists a deficit of old growth, recruitment OGMAs must be established so that the old growth target will be achieved in the shortest possible time frame (*LU Planning Guide* p. 30).

For LUs with a low biodiversity emphasis, the OGMA target may be drawn down by two thirds of the recommended targets (*LU Planning Guide, Appendix 2*). It is only acceptable to establish more than 1/3 of the OGMA target if it is determined through a timber supply analysis associated with the Timber Supply Review (TSR) that it will not cause additional timber supply impacts (*LU Planning Guide* p. 30).

If (for LUs with a low biodiversity emphasis) the full OGMA target is not delineated and established, then a recruitment strategy must be developed that describes how to meet the target by the end of the third rotation (*LU Planning Guide* p. 30).

Appendix 2 of the *LU Planning Guide* details landscape level biodiversity objectives and seral stage retention targets for each Natural Disturbance Type (NDT).

Base Case assumptions for landscape units

Where LUs have been established by the district manager, they must be used in the base case. Where they have not been established, use the most recent draft LUs. Include in the IP a description of the status of the LU planning process.

Where the TFL forms only a part of a LU, for timber supply analysis the old growth targets should be applied to the TFL portion of the LU. The assumption is that if each administrative unit meets the old growth objectives, then the objectives will be met for the LU as a whole.

Where designated parks are located within the LU, a portion of the old growth within the park (area weighted…TFL area to LU area) may contribute to the old growth targets for the TFL. The potential contribution of reserved old growth areas outside the TFL to the old growth targets within the TFL should be discussed with Forest Service district and Ministry of Environment staff and the Timber Supply Forester before including related assumptions in the IP.

Base Case assumptions for biodiversity emphasis options

Where OGMAs have been established, they should be accounted for in the base case. The process for establishing all the necessary OGMAs for each LU will likely take some time. Where the process is incomplete and some OGMAs have been established, the method to be used in the model for reflecting OGMAs in conjunction with the old seral targets should be discussed with Ministry of Forests district staff, Ministry of Environment staff and the Timber Supply Forester prior to submitting the IP.

In the base case, all old growth targets must be applied at the biogeoclimatic variant level (unless a Resource Management Zone objective directing representation at a finer level has been established as a higher level plan or the chief forester has permitted an exception).

Where LUs and BEOs have been established, old growth targets reflecting the established BEOs for each LU must be modelled in the base case. Old growth targets are documented in Appendix 2 of the *LU Planning Guide.*

Where LUs have not been established (i.e. where LUs are draft), government's policy direction documented on page 9 of the Biodiversity Guide Book (September, 1995) will be applied in the base case. According to the policy, approximately 45 percent of each LU will be in the lower BEO, 45 percent in the intermediate BEO and ten percent in the higher BEO. As a result, in the base case the area weighted average (i.e. 45/45/10) biodiversity constraints for the three BEOs will be applied for each variant in each draft LU.

For established LUs with a lower BEO and for the lower BEO portion (45%) of the old growth constraint in draft LUs, the target for the first rotation (80 years unless otherwise agreed to by the DM and Designated Environment Official) should be drawn down by 2/3. The objective is to attain the full old seral target in three rotations (240 years) in

areas managed for a lower BEO. Usually the constraint applied in the model is 1/3 of the full old seral target for the first rotation, 2/3 for the second and 3/3 for the third. The expectation is that this modelling strategy will ensure that after three rotations sufficient old growth will be available to satisfy the full old seral target.

Table 40 is an example of the kind of information that should be included in the IP.

Table 40 Old seral targets

Landscape Unit	BEC variant	NDT	Area (ha)		BEO	Old age	Old seral constraint (% of productive)		
			Prod.	THLB			1st rot	2nd rot	3rd rot.
Prasad	ICHmk1	3	3392	2569	45/45/10	140	10.5	12.6	14.7
Koch	ESSFwc2	1	5978	5125	low	250	6.3	12.7	19
Caribou	CWHmm1	2	4826	2591	Interm.	250	9	9	9

Special instructions for units in the Nelson Forest Region

In the Nelson Forest Region the mature plus old seral constraint must also be applied as timber supply analysis has been completed for that region that shows this constraint can be applied while still meeting the targets set out in the Kootenay-Boundary Land Use Plan.

For units in the Nelson Region a table similar to Table 40 detailing the constraints to be applied for the mature plus old seral constraint should be included in the IP. Note that in low BEO LUs the mature plus old constraint may not be reduced to one third of the target.

Sensitivity analysis

The following table outlines which seral stage constraints from the *LU Planning Guide* must be applied in the base case and which ones in sensitivity analysis.

Table 41 Landscape level biodiversity constraints

	early seral stage	mature plus old seral stage	old seral stage
NDT 1&2			
base case	off	off [1]	on
sensitivity	turn on and just show results	turn on and just show results	on
NDT 3&4			
base case	off	off [1]	on
sensitivity	turn on and just show results	turn on and just show results	on

1: "On" in the Nelson Region

The following two sensitivity analyses must also be conducted:

- show the impact on timber supply of applying the full old seral target in low BEO LUs.
- show the impact on timber supply of applying the old seral constraint reflecting the draft BEOs for each LU (Where LUs and BEOs have not been established).

10.2.6.2 *Wildlife Tree Retention*

Background

One of the two priorities for LU planning is to establish LU objectives for wildlife tree retention.

Section 3.2 and Appendix 3 of the *Landscape Unit Planning Guide (March 1999)* detail the process for calculating wildlife tree retention requirements at the subzone level in order to establish LU objectives. Varying from these procedures may be necessary where an established higher level plan exists and directs otherwise.

On May 15, 2000, the Assistant Deputy Ministers of Forests and Environment, Lands and Parks approved changes to section 3.2 of the Landscape Unit Planning Guide. Further detailed policy on management of wildlife trees is provided in the document *Provincial Wildlife Tree Policy and Management Recommendations (February, 2000).* The planning guide changes and the recommendations are available on the MOF Forest Practices Branch web site (http://www.for.gov.bc.ca/hfp/planning/lup/index.htm).

Operational planning for Wildlife Tree Retention

For operational planning, the *Landscape Unit Planning Guide (page 35a, note to step 4)* states if OGMAs have not been established, Table A3.2 in Appendix 3 of the Guide should be used to determine the level of wildlife tree retention required and if OGMAs have been established, Table A3.1 should be used.

Base case assumptions for Wildlife Tree Retention

Where OGMAs have been established, base case assumptions should reflect the management of these areas.

Where OGMAs have not been established, Table A3.1 should be used in the base case. This approach recognizes that the OGMAs that will eventually be established will be comprised of the same old seral forest composition that is modelled in the base case (i.e. the composition of OGMAs and the old seral forest cover requirements applied in the base case are derived from the same tables in appendix 2). In addition, the intent is to identify and establish OGMAs within the next few years. As a result, Table A3.1 will be applicable in operations for most of the 250-year period forecast in the analysis.

Wildlife tree retention may be accounted for through a land base reduction or a volume reduction. If the intention is to permanently retain wildlife trees, they should be accounted for through a land base reduction and the method used described in section 6, above. If wildlife trees will be replaced over time, a volume reduction at harvest may be more appropriate.

The following table is an example of the information that should be included in the information package.

Table 42 Wildlife tree retention constraints

Landscape Unit	BEC subzone	Forested area (ha)	THLB (ha)	% subzone available for harvest	% THLB harvested	Total wildlife tree retention (%)	THLB retention area (ha)
A	SBSdk	58957	49524	84	30	8	1980
A	ESSFmc	13709	10967	80	10	6	439

Please describe in detail and justify the method used to account for wildlife trees and patches.

10.2.6.3 *Coarse Woody Debris*

Current Coarse Woody Debris (CWD) policy enables the management of CWD only within harvesting utilization standards. While the importance of CWD is clearly recognized within the FPC regulations, detailed provincial CWD management guidelines are currently lacking.

CWD management objectives must be defined in forest development plans and must be balanced with other, potentially competing, stand management objectives such as fuel management. At present forest companies are encouraged to leave behind as much CWD as possible provided it does not exceed the minimum utilization standards or interfere with other stand management objectives such as forest health.

In timber supply analysis for AAC determinations there is presently no need to account for CWD because the yield tables used to project timber supply only include the volume of timber that exceeds minimum utilization standards.

If and when a guideline or policy is developed that requires a level of CWD maintenance that exceeds minimum utilization standards, or if a higher level plan objective dictates that a level of CWD maintenance exceeding minimum utilization standards is required, licensees are expected to account for CWD volumes exceeding minimum utilization standards in the base case of the timber supply analysis. The assumptions used to account for CWD must be clearly described in the information package.

10.2.6.4 *Objectives for patch size distribution*

According the *Landscape Unit Planning Guide* (March, 1999), planning for the temporal and spatial distribution of cutblocks (patch size) is not a short-term priority for biodiversity planning (LU Planning Guide, Section 6.1). According to section 3.3, detailed procedures for assessing patch size are still being developed. Objectives for patch size should be tested as draft prior to legal establishment. Section 4.6 C further explains the process to be used for establishing draft objectives for patch size distribution.

Unless objectives for patch size distribution have been legally established, they should not be modelled in the base case. Any assumptions for sensitivity analysis should be clearly documented in the IP. In addition, the status of the process leading to establishment of patch size distribution objectives should be described.

10.2.6.5 Objectives for *connectivity*

According the *Landscape Unit Planning Guide* , Section 6.1, landscape connectivity is not a short-term priority for biodiversity planning.

According to section 3.5 of the guide, current policy directs that maintenance of connectivity should not have a timber supply impact. It must be accomplished through

strategic location of the OGMAs, partial cutting strategies, the planned distribution of cutblocks and through existing constrained areas such as riparian reserve zones (*LU Planning Guide*, p. 39). Legally established Resource Management Zone objectives may influence how and where connectivity is managed. Where connectivity is addressed, it should be done through draft objectives and the implications to timber supply should be explored in sensitivity analysis.

10.2.6.6 Watersheds

Community watersheds

In this section describe the objectives and modelling assumptions to be used for community watersheds. These must be developed in accordance with the Community Watershed Guidebook (October, 1996). In developing modelling assumptions, particular attention must be given to section 6, Riparian management and section 8, Harvest scheduling and cutblock size. Where watershed assessment information is available, it must be used to develop forest cover requirements for the community watersheds. Where no better information is available, the constraint described in section 8.2.2, Equivalent clear-cut limits on sub-basins may be used.

Table 43 Community watersheds

Name	Productive area (ha)	THLB area (ha)	Current ECA	allowable ECA	Forest cover requirement	
					Greenup age	Allowable denudation %

Watershed assessments

For watersheds where management is proceeding in accordance with completed watershed assessment procedures, assumptions should be included in the base case to reflect this management. The proposed method to be used in the base case to account for this management must be described in detail in the information package. A table similar to Table 43, above, should be included in the IP.

10.2.6.7 Riparian management zones

As described in section 6.9, in this section please describe the information available (e.g. current operational practice) and the management practices applied within this zone. The

description might include forest inventory characteristics, harvesting pattern and merchantable volume retention. Also include details on proposed modelling methods (e.g. forest cover requirement, yield table volume reduction). The following table is an example of the kind of information that should be included.

Table 44. Riparian management zones

					e.g.forest cover requirement		e.g.volume retention
zone	riparian class	length or perimeter	RMZ width	RMZ area	minimum retention	age (years)	
	e.g. S2	50 km	40 m	166ha	40 %	80	
	e.g. S4	96 km	60 m	472 ha			10 %
	e.g. L3	5 km	30 m	8 ha	25 %	120	

10.2.6.8 Higher level plans

The management objectives of any higher level plans that are in place must be described in this package along with the methods to be used to account for them in the timber supply analysis. Detailed information may be better described under each section of the package and identified as being part of the higher level plan. In some situations it may be better to describe under one heading the higher level plan objectives and the methods used to account for them in the analysis.

If the declaration of a higher level plan is imminent, or if management emphases associated with the plan are in draft form, it may be warranted to provide an option that demonstrates the timber supply implications of the imminent or draft plan. Proposed inclusion in the base case of draft higher level plan assumptions should be discussed with the Timber Supply Forester during the preparation of the IP.

10.2.6.9 Any other non-timber resource management

Licensees are expected to keep informed of new or changed management requirements for non-timber resources. Where and when these are tied to timber supply, they must be accounted for in the base case or in a sensitivity analysis. The licensee should discuss any new timber supply related issues with the Timber Supply Forester during the preparation of the IP.

10.3 Timber harvesting

10.3.1 Minimum harvestable age/ merchantability standards

The purpose of this section is to identify the minimum criteria stands in an analysis unit must meet to be eligible for harvest. Economic factors will likely dictate the threshold when stands are deemed to be candidates for harvest. During periods of timber supply shortage the characteristics of stands that will be harvested will likely approach the minimum thresholds. For the purpose of timber supply modelling, these characteristics are often expressed in terms of volume per hectare and/or average diameter. In the model, the age at which the minimum thresholds are attained is then assumed to be the minimum harvestable age.

For each option considered, the minimum merchantability standard must reflect the assumptions used in that option (e.g., sawlogs, pulplogs).

Note that these are simply minimum criteria. While harvesting of stands at the minimum thresholds may occur in order to meet forest level objectives (e.g. maintaining overall harvest levels for a short period of time or avoiding large interdecadal changes in harvest levels), some stands may be not be harvested until well past "optimal" timber production ages when management of other resource values take precedence (e.g. requirements for the retention of older forest).

Culmination age has also been used in timber supply analysis as the minimum harvestable age. Whatever ages are chosen, they must be supported with a reasoned explanation of the choice made.

Statistics at culmination age should be included in Table 39 for reference.

Table 46. Minimum merchantability standards

Zone/ group	Analysis Unit	Minimum harvestable age (years)	Minimum Average Stand Volume (m^3/ha)	Minimum Average Stand Diameter (cm)	Culmination		
					Age (years)	Average Stand Volume (m^3/ha)	Average Stand Diameter (cm)

Discussion: (please explain how each minimum standard was determined and how they are applied).

10.3.2 Operability

The purpose of this section is to describe the assumptions that are used in determining the operable land base. These assumptions are usually based on physical and/or economic limitations to accessing stands that would otherwise be available for harvest.

The operable area can be divided into areas that are harvested using different harvest methods. These harvest methods usually fall into either the "conventional harvesting" category (i.e. harvest methods that are considered to be the usual methods used to harvest timber on the TFL) or the "non-conventional harvesting" category (i.e. harvest methods that are not often used or are new to operations on the TFL). The definition of "conventional" and "non-conventional" should be discussed with Forest Service district staff prior to completing the operability mapping discussed below.

Operability assumptions used in the base case must conform to the assumptions used in the operability mapping. The mapping must be submitted to and accepted by the district manager (or his/her staff) for each process leading to a new determination of the AAC.

Include the date operability mapping was accepted and the name of the Forest Service officer who approved it.

Table 47. Operability approval

Date Approved:	Approved By:

Where areas that are accessible using non-conventional harvesting methods are proposed for inclusion in the base case timber harvesting land base, their inclusion must be supported (in the IP) by evidence of recent harvest performance in these areas. Where limited harvesting has been conducted in areas accessible using non-conventional harvest methods, the impact on timber supply of including the non-conventional areas should be investigated using sensitivity analysis or in an option.

Please provide a detailed description of the assumptions and methods used in determining the operable land base. If areas are proposed for inclusion in the timber harvesting land base that were not included before, provide justification for including them this time (e.g. recent performance information).

The purpose of Table 48 is to summarize by harvest method (e.g. skidder, highlead, long line, helicopter, feller buncher, etc.) the results of the operability assessment.

Table 48. Harvest methods

Zone/ group	Harvest Method	Area (ha)	Volume (m^3)
	Total Conventional		
	Total Non-conventional		
	Younger than harvest age		
	Operable land base		

Note: If second growth is being harvested, please provide the breakdown between old growth and second growth harvest by harvest method.

10.3.3 Initial harvest rate

The purpose of this section is to explain the rationale and/or method used in establishing the initial harvest rate for the base case. This should also be explained for each option and sensitivity analysis.

10.3.4 Harvest rules

The purpose of this section is to document the harvest rules that are used in modelling the base case and other options and sensitivity analyses. Several harvest rules have been used in timber supply analysis. For many harvest forecasts the absolute oldest stands are harvested first in the model. The use of the relative oldest first harvest rule is also widely used, whereby stands with the greatest difference between their age and their minimum harvestable age are harvested first. Other harvest rules may be used as well. For the base case, the rule applied should reflect current operational conditions.

Table 49. Harvest rule

Option/sensitivity analysis	Harvest Rule	Description

If more detailed methods are used please describe them here.

10.3.5 Harvest profile

The purpose of this section is to document the methods that will be used in the model to account for the assumed harvest profile by species (or analysis unit or other). This profile may, for example, be specified in terms of minimum, maximum or actual area or volume or percent area or volume harvested by decade.

This information is used to forecast potential deficits in particular species or forest types, and to examine the impact on sustainable harvest levels of harvesting different species profiles. It may also be used in an option that targets the areas specified in a 20-year-plan for the first two decades of the forecast period.

Criteria used to define the harvest profile:

Table 50. Harvest profile

Analysis Unit	e.g. Volume or Area Harvested by Decade[1]			
	1	2	3	4
1.				
2.				
3.				
e.t.c.				

Note: Include more decades if necessary.

[1] Or volume (m^3), area (hectares) by decade.

10.3.6 Silvicultural systems

List the silvicultural systems currently employed on the TFL with the respective silvicultural regime. Certain practices may be geographically specific, such as selection harvesting, and these will have to be examined in relation to the corresponding forest cover requirements. Riparian management or wildlife considerations should also be described if some partial cutting system is prescribed.

Management strategies and the method proposed for incorporation in the base case and/or sensitivity analysis must be fully documented in the information package for each component of a variable retention management system.

Effects and the method used to account for the effects of each silvicultural system or each component of a variable retention management system on growth and yield (e.g. shading effects, residual stand volume and growth) must be reviewed and accepted by research branch staff. Licensees should discuss proposed methods with research branch staff before preparing the information package.

Table 51. Silvicultural systems

Silvicultural system	Eligible Analysis Units or Locations	Productive area (ha)	THLB area (ha)	% retention	# of entries	Time between entries (years)
e.g. partial cut (RMZ)	spruce types			50 %	1	80
e.g. selection	all			70 %	3	30
Silvicultural system	**Eligible Analysis Units or Locations**	**Productive area (ha)**	**THLB area (ha)**	**% retention**	**# of entries**	**Time between entries (years)**
e.g. partial cut (RMZ)	spruce types			50 %	1	80
e.g. selection	all			70 %	3	30

Please describe in detail the information source and provide any necessary comments.

Description of methods used:
e.g. growth and yield model used, method used to model partial harvesting

10.3.7 Harvest flow objectives

Knowledge of the underlying assumptions about harvest flow, or pattern over time, are essential to enable interpretation of timber supply analyses. Guidance in developing harvest flow objectives is taken from the current economic and social objectives of the Crown expressed by the Minister of Forests in a letter to the chief forester in 1994. He emphasized the importance of the continued availability of good forest jobs and the long-

term stability of communities that rely on forests. He stated that any decreases in allowable cut at this time should be no larger than necessary to avoid compromising long-run sustainability.

Thus, an attempt should be made to attain the current AAC for as long as possible in the base case and then decline at a reasonable rate (< 10 % per decade if possible) to the long-term harvest level. The long-term harvest level is the highest harvest level that can be attained for the long-term while maintaining a stable (flat line) total inventory.

Situations may occur where a medium term decline below the long-term harvest level is warranted. In some cases modelling initial harvest levels above the current AAC may also be warranted. Licensee analysts should review several timber supply analyses for Timber Supply Areas (TSA) to gain a better understanding of harvest flow patterns currently considered by the chief forester in making AAC determinations. In addition they should contact the Timber Supply Forester at Timber Supply Branch to discuss any marked departures from the harvest flow objectives that are common in TSA analyses.

The purpose of this section is to describe the objectives that are used in modelling the harvest flow for the base case, each option and each sensitivity analysis (e.g. harvest at current AAC and decline at no more than 6% per decade to the long term harvest level; unconstrained; harvest at current AAC whenever possible, etc.).

Table 52. Harvest flow objectives

Harvest flow objectives for option: _____
1.
2.
3.
4.
↓

10.4 Other

Include any other information not covered by this guide that impacts on timber supply. If this information cannot be incorporated into the model, provide estimates of impacts on timber supply in the short, medium and long term.

If this information is incorporated in the model, provide the information source operational requirements, performance information and discuss the modelling methods used.

11 Option assumptions

In this section please describe in detail the assumptions that are used for each option. Note that this may have been adequately covered in Table 2. Only the differences between the assumptions in the base case and the option need to be documented. Include land base information (e.g. land base reduction table) and any other relevant information in a similar format to the assumptions documented for the base case that will help describe the intent of the option.

Tree Farm Licence Information Package Guide

Appendix I

Standardized Format For Yield Table Submissions other than VDYP and TIPSY

June, 2000

Purpose

The review of yield tables submitted in TFL management plans is time consuming. A common standard for the submission of yield table data will facilitate the review undertaken by Research and Inventory Branch staff. The following is the required format:

Standard of Submission

- Submit yield table data in DOS compatible ASCII format;
- Submit each table in a separate DOS file;
- Submit all files (i.e., tables) in the same format; and
- Use mnemonic naming conventions.

Format of Yield Table Data File

Each file shall contain two main sections; the header information and the yield information as follows.

1) Header Information

Describe each yield table using exactly 15 lines (blank lines are permitted). The following information is required in the header:

- Identification (e.g., Title, TFL#, MWP#);
- Site index (50 years breast height-age);
- Initial planting or establishment density (stems/hectare);
- Time and details of treatments (e.g., spacing, fertilising, etc.);
- Merchantable specifications (dbh limit, top diameter, and stump height);
- Percentage reductions (if applicable) for decay, waste, and breakage. State if the tables are gross, or net of these reductions?
- Other netdowns (e.g. %, m3/ha) for operational falldown (e.g. operational adjustment factors). Are tables gross or net of these reductions?
- Regeneration delay contributing to total age;
- Number of years to reach breast height;
- Maximum mean annual increment (year and amount).

2) Yield Information

Supporting documentation must be included indicating how the yield tables were generated including all assumptions and which site index curves were used.

For yield tables generated using models other than VDYP or TIPSY, the following variables must be included in each table in the stated columns and starting on line number 16:

Column	Variable	Unit
1-5	total age	years
6-10	top height	m
11-20	total volume	m^3/ha
21-30	merchantable volume	m^3/ha
31-40	diameter	cm (specify quadratic or arithmetic mean)
41-50	mean annual increment	m^3/ha/yr.

Additional variables (if applicable) can appear in the remaining columns. The following format is suggested:

Column	Variable	Unit
51-60	basal area	m^2/ha
61-70	density	stems/ha
71-80	optional additional data	

Note: Use 80 columns maximum.

Example of Standard Format

The following example outlines the standard format for yield tables submitted in TFL management plans. The first 15 lines contain header information and the remaining lines contain the yield table data. The header information can be any format, but must use 15 lines. In this example:

the first line of test after the dashed line indicates the first line of the file, and the dashed line after the column heading is marked every 10 columns for your convenience.

1 Header line containing any of the required information
2 Header line containing any of the required information
3 Header line containing any of the required information
4 Header line containing any of the required information
5 Header line containing any of the required information
6 Header line containing any of the required information
7 Header line containing any of the required information
8 Header line containing any of the required information
9 Header line containing any of the required information
10 Header line containing any of the required information
11 Blank lines permitted
12

13	Tot	Top	Total	Merch			
14	Age	Ht.	Vol.	Vol.	Diameter		MAIOther Var.>
15	----------1----------2----------3----------4----------5----------6						
16	10	1.6	0	0	0.1	0	
17	20	4.7	24	0	2.5	0	
18	30	8.0	82	0	5.0	0	
19	40	10.8	142	20		7.6	0.5
20	50	13.3	200	87		9.9	1.7
21	60	15.3	254	161		11.9	2.7
22	70	17.0	298	218		13.5	3.1
23	80	18.4	335	265		14.9	3.3
24	90	19.6	366	304		16.0	3.4
25	100	20.6	388	339		17.1	3.4
26	110	21.5	406	364		18.2	3.3
27	-	-	-	-	-	-	
etc.	-	-	-	-	-	-	

Ministry Approved Yield Table Generation Programs

TIPSY - A Table Interpolation Program for Stand Yields

Contact TIPSY Coordinator at:

British Columbia Ministry of Forests
Research Branch
Forest Productivity and Decision Support Section (FPDS)
P.O. Box 9519, Stn Prov Govt
3rd floor, 712 Yates Street
Victoria, B. C. V8W 9C2

Fax: 387-8197
Phone: 387-6718

VDYP - Variable Density Yield Projection System

Contact Supervisor, Growth and Yield Predictions at:

British Columbia Ministry of Forests
Resources Inventory Branch
P.O. Box 9516, Stn Prov Govt
722 Johnson Street
Victoria, B.C. V8W 9C2

Fax: 387-5999
Phone: 387-6043